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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Methane plume over South Asia during the monsoon season: satellite observation and model simulation" *by* X. Xiong et al.

X. Xiong et al.

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First, we thank the reviewer for their detailed and constructive comments on our paper. We have revised the paper following all the comments given by the reviewer.

General Comments: The reviewer is correct that there are uncertainties in the retrieved CH4 values and model transport, and that CH4 in the lower troposphere can not be accurately retrieved from AIRS. However, under the assumption that the model performs well in simulating the transport and the chemical oxidation of CH4 in the atmosphere, the CH4 in the middle to upper troposphere can be linked with the surface emission. This has been shown from the sensitivity test using the model. Since a higher CH4 in the middle to upper troposphere corresponds to a larger CH4 emission, the larger CH4

from model than AIRS measurements might indicate the emission scenario might be too large. Again we have to assume the uncertainties in the retrieved CH4 values in the middle to upper troposphere are small enough, but this does not have any relation with the lower sensitivity of AIRS in the lower troposphere.

The phrase "... indicate a possible overestimate of CH4 emissions from rice paddies in Southeast Asia." is confusing. To be more accurate, we articulated that "emissions form rice is too high in the scenario with the global emissions from rice of 60 Tg yr-1. Our result is consistent with many recent studies that pointing that the emission converges on the lower end of the range given by IPCC, as commented by reviewer later. The following is what we changed in the abstract, and we also made related changes in the whole paper.

"Further comparisons between the AIRS retrievals and the model simulations suggest a possible overestimate of emissions from rice paddies in Southeast Asia in the scenario with the global emissions from rice of 60 Tg yr-1."

Specific comments:

P13454,L2: We changed the "observations" to "retrievals".

P13454,L20: We agree. We changed the CH4 GWP from "about 20 times" to "over 20 times" since in most literature it is about 20-30 times.

P13456,L22: We removed "valuable AIRS products" and leaved the readers to evaluate its value. However, soon after the publication of this paper in ACPD, we have received several responses from researchers studying CH4 emission from rice and/or transport over the TP, and some are interested in comparing AIRS data with model simulations and aircraft observations. This sentence is updated as:

"Observations by AIRS on EOS/Aqua have provided CH4 products in the middle to upper troposphere since September 2002 to present, and these products have been validated by Xiong et al. (2008)."

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P13457,L11-22: As suggested this paragraph has been revised, and the discussion to results has been removed.

P13457-8: As suggested, a brief description of the retrieval method and its limitations is added in "data and method".

P13458,L27-28: This sentence is updated as:

"To reduce the uncertainty in the analysis of AIRS data, we rejected the profiles with an obvious oscillation outside of the variation range of CH4 in the troposphere, or when the degree of freedom is lower than 0.6."

P13459,L14-15: Good comments. This sentence is updated as

"Since the variation of CH4 emissions from rice agriculture can be large and it is difficult to estimate the regional CH4 emissions, the estimated emissions can range from 31 to 112 Tg yr-1."

Our result is consistent with many recent studies that show the emission converges on the lower end of the range given by IPCC [IPCC, 2007]. The CH4 emissions from rice are likely to have declined in recent years, especially in China where agricultural practices have shifted to intermittent flooding and a greater reliance on nitrogen fertilizers [Li et al., 2002; Khalil and Shearer, 2006].

Section 3.1: YES, the retrievals from other years are consistent with the results shown for 2004. This can be seen from Figure 4. In the context we added:

"Significant increase of CH4 in the middle to upper troposphere in Southeast Asia was observed by AIRS in July, August and September for each year from 2003-2007."

P13464, L18-20: I think there is a typo and I guess the reviewer referred to P13462 instead of P13464. There is no doubt that if the total column can be measured accurately, we can easily evaluate the rice agriculture inventory of CH4 emissions. However, comparison of CH4 in the middle to upper troposphere from satellite measurements with

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model simulations might give some hints to the emissions in this specific circumstance. As replied in general comments, in our study we do not attempt to say the rice agriculture inventory of CH4 emissions is wrong since IPCC gives a large range, and instead, our argument is that emissions form rice might be too high in the scenario with the global emissions from rice of 60 Tg yr-1.

P13463, In Figure 3 we only show the data from AIRS retrievals. The model does give a strong positive gradient in CH4 mixing ratio above Region II in August to September. This gradient is shown in Figure 4.

P13464, Figure 4: Typo of colors in caption has been changed.

Figures 5 and 6: As suggested, both figures have been redrawn.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 13453, 2008.